Alaska Public Broadcasting, Inc.

Project #0117-DC-2004-15
September 30, 2010
Close Out Report

Denali Commission project #0117-DC-2004-15 included two primary work scopes 1) Alaska Rural Communications Service & Satellite Interconnection Revitalization project, and 2) development of a digital distribution network for public broadcasting licensees. This project close out covers a reporting period from February 2004 through June 2010.

Alaska Rural Communications Service & Satellite Interconnection Revitalization

The Alaska Rural Communications Service (ARCS) & Satellite Interconnection Revitalization Project is complete. For the past six years, Denali Commission funds helped bush and rural Alaskans realize the potential and value of their state's low power television (LPTV) service. Denali Commission funding has kept many remote parts of Alaska connected to the world by facilitating restoration of ARCS to bush and rural communities by either repairing or replacing non operational equipment.

During the 1990s the state reduced and then eliminated its repair and maintenance capabilities for ARCS (Rural Alaska Television Network or RATNET back then), including the 'last mile' equipment fleet installed in more than 200 villages. However, the need for the public service programming continued as demonstrated by the actions of many individuals and organizations in remote communities that struggled to fulfill that repair and maintenance role with their own sweat, time, and money. Despite their volunteer efforts, after just a few years the statewide system fell into serious disrepair and was in danger of collapsing. Alaska Public Broadcasting, Inc (APBI) requested funding from the Denali Commission and with the assistance of Senator Ted Stevens received a grant to help rebuild and refurbish the ARCS system.

Denali Commission funds helped to reverse the rapid deterioration of this important telecommunications infrastructure that delivers many bush and rural residents their only free over the air television service and reliable access to the state's Emergency Alert System (EAS). The infrastructure revitalization work was done in partnership between APBI, the University of Alaska, the State, the Denali Commission and many community based volunteers. After reviewing the quarterly reports filed over the life of the grant, the following project outcomes and highlights are noted.

Project Outcomes & Challenges

The ARCS technical support desk at APBI handles over a thousand contacts each year from viewers, volunteers and other interested parties regarding some technical aspect of the ARCS system. During the grant period every community in the state was contacted at some point. In communities that did not have any ARCS service at the time of contact, APBI was able to restore service in more than 150 cases. In addition, many communities with degraded service

issues had their technical issues resolved bringing service back to acceptable levels. Between April 2004 and June 2010, APBI refurbished or purchased and distributed over 115 transmitters with new modulators in them and an equal amount of sate satellite receivers. APBI put over 70 line conditioners in remote sites and swapped out an additional 47 modulators from refurbished transmitters. In over 100 other cases, APBI sent out transmission lines, satellite cables, antennas, LNB's, feed horns or other materials. Remaining stock includes another 10 transmitters with modulators, 12 satellite receivers, 8 modulators, and 6 line conditioners. These comprise a small set of spares and are available to deploy as needed.

A major portion of the project work scope was aimed at remote equipment in villages. While the original transmitters proved they could be rebuilt, the modulators originally installed by the state in the 1980s contained parts that were no longer available. They needed complete replacement and arrangements were made with the factory to include a new modulator when rebuilding an old transmitter. This method proved advantageous; however, irregular electrical power in the villages is a fact of life and a major culprit in the number of equipment failures. In order to protect the new and refurbished ARCS equipment from frequent surges and brownouts, APBI included new voltage regulators in many of our shipments. These added a two to five year window of protection depending on the site. Even so, refurbishing the power supplies on new modulators soon became a regular undertaking.

The project work scope also focused on addressing the aging distribution system consisting of program aggregation and switching, and the satellite uplink suite. In 2007 the uplink suite was consolidated, along with the delivery systems for three other statewide public service television systems and a number of public radio services, into a single uplink in Fairbanks. This consolidation involved the complete upgrade and replacement of an outdated infrastructure, while maintaining complete compatibility with the installed user base of the existing satellite receiver fleet. It resulted in improved performance at all downlink sites in terms of both performance of the RF carrier and quality of the television picture seen by viewers in their homes across Alaska. It also opened the door to the future possibility of multichannel digital television for ARCS viewers.

The following site specific examples are representative of the kind of service restoral work done with Denali funding and reported upon throughout the life of the grant via the quarterly report requirement. These community projects were completed in partnership with local volunteers and organizations putting forward their time, space and electricity, and funding.

- Through a partnership with the public radio station in Saint Paul, purchased and built a new 4.5 meter rough duty satellite dish antenna in one of the most extreme climates on the planet.
- Replaced the transmitter at the top of the remote Willow Mountain site. The new transmitter serves a 30 mile stretch of communities along the Richardson highway from Kenny Lake to Copper Center.

- Purchased and installed a new transmitter for the site atop Tolsona Ridge, restoring coverage from Glennallen to Lake Louise. At 3000 feet, this site is fed by a microwave relay and is only accessible by helicopter.
- Repaired a damaged 4.5 meter steel satellite dish in Stony River. Repairing or replacing the huge steel satellite dishes is the most difficult and expensive aspect of any ARCS site. In False Pass and Nondalton repair was not an option so smaller replacement dishes and mounts were purchased and installed.
- At Gambell, on the remote St. Lawrence Island in the middle of the Bering Sea, the satellite dish sat inactive for years after extreme weather damaged the feed horn. Replacement parts were ordered and shipped, the dish repaired, and electrical components put back in place, but it was the ability to work with local volunteers to assess and diagnose the problem and perform all the field work that was key in restoring ARCS to the community. This is the method used over and over again to achieve successful results in many other communities.

As a year round 24/7 service, the satellite and LPTV components of the ARCS signal provide access to emergency information for individual viewers as well as commercial and noncommercial broadcasters throughout Alaska. ARCS picks up over the air the designated state Primary Entry Point (PEP) station, digitizes the audio and transmits it via the Denali funded digital distribution network to the Fairbanks uplink suite where it is routed to the ARCS channel's EAS decoder at the output of the ARCS video switcher. By doing so, ARCS provides all users the top level EAS information channel for the entire state and nation. ARCS participates in the State of Alaska EAS Plan, maintains a membership role in the Alaska State Emergency Communications Committee (SECC), and is a designated monitoring assignment choice available to all Alaska broadcasters below the PEP.

A small component of this work scope, the test of low power digital transmitters, did not come to fruition for two reasons. First, the equipment wasn't available in a form that would have provided a meaningful test until recently. By the time suitable equipment was available our test partner was no longer able to participate in the manner originally envisioned. APBI still plans to conduct this test, however, it will be done with non-Denali funding.

Summary

For many bush and rural Alaskans, ARCS is the only television service they get as not all communities have cable and or satellite and lots of folks can't afford to pay for these services even if available. The Denali Commission funding reversed the rapid deterioration of this important telecommunications infrastructure. Many bush and rural communities got back or kept their only free over the air television service. The delivery infrastructure for statewide distribution of content was modernized and strategically placed for next step-digital multi channel services for rural Alaska, including enhanced EAS services and other as yet unexplored options for the bandwidth. All of this work was done in partnership between APBI, the University of Alaska, the State, the Denali Commission and community based volunteers.

In each of the communities where ARCS service was restored, people's lives and livelihoods were improved. ARCS is an information lifeline serving some of Alaska's most un-served and under-served residents. Their commitment to ARCS is testimony to the value they place on the system and the service it provides. Funding from the Denali Commission breathed new life into ARCS. The next step in the evolution of ARCS - digital conversion of the low power transmitters - offers significant increases in public service programming to viewers. It would not be possible to consider that expansion of service without the Denali Commission funding that accomplished so much over the past six years.

Digital Distribution Network

The project objective was the interconnection of public broadcasting system facilities by means of the internet or constructed intranet. Upon completion of the network, delivery of content - programming, data and voice - and access to advanced networking options would be available to the system of stations, enhancing service to local, regional and statewide audiences. The project was developed and implemented by APBI in partnership with 26 public radio stations, 4 public television stations, the University of Alaska, the Corporation for Public Broadcasting and the Denali Commission.

In March 2004, APBI engaged IT consultants for the purposes of designing and implementing the data networking project. The project's main infrastructure goals consisted of integrating Alaska's public broadcasting system to the University of Alaska IP backbone while provisioning each broadcast media licensee site with a common IP networking solution. These infrastructure goals were in support of functional technology goals which stood to:

- reduce operational costs for the Alaska broadcasting licensees through standardization and migration to an IP-centric broadcasting model
- provide for a common statewide media (IP voice/video) standard among/between stations facilitating inter-station cooperation/work over an integrated "intranet"
- equip licensees for "next-generation" relevancy in a changing media ecology through a basic IT investment (IP router, LAN switching, terminal server, security appliance and uninterruptible power supply) with a projected 5-7 year life cycle which would integrate station voice/video/data functions, connecting them to the public Internet
- development of an "administrative center" for the network which would provide practical operational controls
- equip all rural licensees with a dedicated, engineered access pathway to the statewide backbone (which would connect the three major (urban) radio/television joint licensees over the UA IP networking system)
- enable consolidation of three, separate aging analogue broadcast uplinks into a single digital uplink for statewide content distribution via satellite on ARCS and "modernize"

ARCS content management through implementation of IP-based management and control systems

- integrate IP-based management and control systems for remote monitoring and management of distributed transmitter systems throughout the Alaska public broadcasting community, providing for centralized engineering support service model

Project Outcomes & Challenges

The project placed state of the art equipment at stations to facilitate public service opportunities in the digital era. Station managers recognize its utility and value in addressing current and future digital content acquisition and distribution needs. The next extension of the digital age for the public radio stations is the conversion to new digital transmission equipment. This core digital technology will play an integral role in this infrastructure evolution for years to come.

Group purchasing of the data network equipment resulted in competitive bidding that yielded an average discount of 31% saving $465,000. While the design life for this equipment was 5-7 years, in most cases it will adequately support station needs for 10 or more years unless significant increases in demand for digital integration force earlier upgrades.

The grant also provided for some extensive training in this new technology for the technicians and engineers in the system- a week working with highly qualified trainers in a hands-on environment. This training helped facilitate increased adoption of the new technology, provided a clear understanding of the operation and maintenance of the network components and created a knowledge base for future needs.

The vast majority of the project goals were achieved. The primary exception to this was development of a dedicated, engineered IP WAN backbone between rural licensee locations and the statewide network linking Fairbanks, Anchorage and Juneau. While all conceivable solutions were exhaustively researched, it was found prohibitively expensive to link the rural sites to the rail belt backbone with dedicated links. As such, an alternative IP virtual private network (VPN) model was pursued: sites were provided a ready model for linking back into a common system via secured/encrypted IPSec tunnel.

While many licensees were actively engaged in the project, some rural licensees were initially less prone to see the overall integration efforts in a positive light. As a result, at some locations the IT solution was never adequately absorbed into the ongoing operations of the rural licensee and the net effect was a "fractured" system.

Another challenge was the development of the "administrative center" for the network's ongoing operations (post-project). Initially difficult to develop, this was eventually handed to the University of Alaska "Statewide" IT management group.

The University of Alaska partnership resulted in a multi-year agreement with the UA statewide office of information technology for provision of connectivity between the hubs via the UA data backbone; and operational oversight of the network on a twenty-four hour basis. This oversight provides rapid reporting of problems so system maintenance and repair can be provided with minimal down time for network users.

The remote transmitter control sub-project was not completed due to the complex nature and high cost of the software and the lack of a clear funding source for a centralized engineering office to implement and manage the project. However, it remains a clear option for the future.

Chronology of Project Implementation

- Initial phase RFQ/procurement process for APBI, KAKM, KTOO and KUAC backbone site equipment -- March 2004
- First components arrive in Anchorage (APC UPS, UPS control cards, Cisco commodity components) -- April/May 2004
- Prepping RFQ/Procurement process for remote public broadcasting site equipment -- June 2004
- APBI main "initial phase administrative center" build completed -- August 2004
- Completion of system integration planning/agreements with UA IT staff members, including IPv4 addressing/subnet assignments to APBI and routing and interfacing details -- September 2004
- First UA System "major administrative unit" (MAU) site integration/turn-up -- KUAC studios and Butrovich Building, UAF campus; upgraded local area network (LAN) at KUAC studio location and installed aggregation and dial tone gateway routers in supercomputing center, along with server-based network operations management software -- October 2004
- Second UA System MAU site integration/turn-up -- KTOO Juneau, KTOO building; provided LAN upgrade at KTOO as well as aggregation and dial tone gateway router installs; major UPS upgrade/installation in support of entire Juneau broadcasting operation -- November 2004
- Third UA System MAU site integration/turn-up -- KAKM Anchorage, Arts Building, UA campus; provided LAN upgrade options to KAKM as well as aggregation and dial tone gateway router installs, major UPS upgrade/installation in support of just the APBI data networking equipment -- April/May 2005
- First remote/rural licensee sites installed and cross-integrated to one another (Coast Alaska sites in Southeast) Sitka, Petersburg, Wrangell, Ketchikan -- May/June 2005
- Completed site integration of all three MAU locations (Fairbanks - fiber; Anchorage - RF; Juneau - copper) and verified fiber optic-based connectivity between all three locations

via the University statewide backbone, enabling ongoing development and testing of video-over-IP broadcasting functionality -- August/September 2005

- South-central site locations equipment packages developed/shipped pre-stage for further deployment efforts at Homer, Kenai, Valdez and Talkeetna -- September 2005
- Continuing installation at rural licensee sites (KHNS, Haines) and prep for further installations at KMXT, Kodiak, and KDLG, Dillingham -- October 2005
- Rural licensee site installs at: KTNA, Talkeetna; KBBI, Homer; KMXT, Kodiak -- November 2005
- Development of integrated IPSec VPN cross-connecting all CoastAlaska sites with KTOO site in Juneau (and, by extension, to the UA backbone) proceeds, along with mentoring of southeast IT support staff on IPSec VPN functionality and operation/maintenance -- December 2005
- Continuing installation at rural licensee sites (KCHU, Valdez) and integration of second IPSec VPN cross-connecting all south central sites with KAKM in Anchorage (and, by extension, to the UA backbone) -- January 2006
- Continuing installation at rural licensee sites: Dillingham, Bethel, Chevak, Barrow, Kotzebue, Fort Yukon, McGrath, Sand Point, Dutch Harbor, St. Paul, Unalakleet -- February 2006 - August 2007
- Implementation of first automated IP video multiplexer carrying programmed content from KAKM to KUAC for consolidated uplink tested and completed -- November 2006
- Continued integration and development of IP-based control, automation and monitoring systems for individual stations/systems that are integrated to the data network, including transmitter systems, power quality monitoring, power availability monitoring, etc. -- December 2006 - June 2007
- R&D of potential IP backbone systems (alternative satellite carrier options, primarily) continues -- February 2006 - July 2007
- Implementation of "example" VoIP telephony system at APBI administrative headquarters to provide example of how connected stations may leverage the data network to their advantage for integrated voice communications/toll bypass functions -- November 2007

Summary

This project helped station managers realize that the digital age was upon them and that systematic integration of digital content and distribution required quality equipment and a well thought out local network in order to provide the highest quality service to listeners and viewers. The grant provided modern equipment for local network solutions, replacing in most cases very basic equipment with limited quality, versatility and functionality. The integrated equipment improved local networking ability, especially with the advent of the digital

distribution of content from National Public Radio. Other applications include replacement of telephone systems, daily use of the system for distributing of content around their stations, improved internal controls, and content distribution between stations.

Conclusion

This project has had a tremendous public service impact on ARCS communities and public broadcasting licensees and their respective listening and viewing audiences across Alaska. Denali Commission funding has allowed for refurbishment, replacement, upgrading and modernization of critical telecommunications equipment and infrastructure on a statewide level. On behalf of the listeners, viewers, stakeholders and partners involved with this project, APBI expresses thanks and appreciation for the funding and the privilege of being a project partner. And thanks to the Denali Commission staff for being professional, helpful and easy to work with over the course of the project.

Final note: the project has a balance of $174.50. APBI got as close as possible to the grant total without going over.

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